REMARKS

Claims 1-3, 5-27, 29-51, 53-75, and 77-104 are currently pending in the Application. Claims 1, 25, 49, and 73 are independent. No new matter has been added. Applicants respectfully request reconsideration in view of the following remarks.

I. Claim Rejections under 35 U.S.C. § 101

The Examiner rejected claim 73, stating that the claimed invention is allegedly directed to non-statutory subject matter because "it is required that 'an information carrier' that embodies 'a computer program product' be a physical hardware such as a computer readable memory storing the computer program product." Additionally, the Examiner states that a computer program product is not described in Applicants' specification.

Case law is well-settled that a computer program product claim is drawn to patentable subject matter so long as the program is embodied in a tangible medium. *See, e.g., In re Beauregard*, 53 F.3d 1583 (Fed. Cir. 1995); *In re Lowry*, 32 F.3d 1579 (Fed. Cir. 1994). Under the *Beauregard* line of cases, Applicants respectfully submit that claim 73 – which recites a computer program product, *tangibly embodied in an information carrier*, for obtaining a channel estimate – is drawn to patentable subject matter.

Further, Applicants respectfully point out that the application as originally filed included claims drawn to a computer program having steps that mirrored the steps of the method described in the specification. The output or "product" of this originally-claimed computer program is inherent within the specification's description of the method outcome. For at least these reasons, Applicants respectfully request withdrawal of the rejection of claim 73 and all claims depending from claim 73.

II. Claim Rejections based on Dependency

The Examiner rejected claims 5, 6, 9-16, 23, 27, 29-51, 53-72, 75-78 and 81-89, stating only that these claims "are rejected due to their dependency to parent claims." Pursuant to 35 U.S.C. § 282, however, each claim – both dependent and independent – is considered to be a distinct invention, and the validity of each claim must be considered separately. Applicants therefore request that the Examiner either articulate specific grounds for his rejection of each of

claims 5, 6, 9-16, 23, 27, 29-51, 53-72, 75-78, and 81-89 or indicate that the claims are allowable.

III. Claim Rejections under 35 U.S.C. § 103

The Examiner rejected claims 1-3, 5-27, 29-51, 53-75, and 77-104 under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Pat. No. 6,996,195 B2 ("Kadous") in view of U.S. Pat. No. 7,099,413 B2 ("Chuang"). Applicants respectfully traverse these rejections.

a. Claim 1 and its dependent claims

Claim 1 is directed to a method that includes receiving a preamble across a channel, the preamble including two or more training sequences, performing a Fourier transform of the training sequences, and deriving initial channel estimates in the frequency domain with the received preamble and a stored preamble. The method further includes receiving data symbols across the channel, demodulating and decoding the data symbols, and updating the channel estimate using the demodulated and decoded data symbols.

The Examiner suggests that Kadous meets the limitations of claim 1. Applicants respectfully disagree. The Examiner acknowledges that Kadous fails to teach or suggest Applicants' step of updating the channel estimate using the demodulated and decoded data symbols, but suggests that Chuang shows this limitation. Again, Applicants respectfully disagree. Applicants respectfully assert that Kadous fails to teach or suggest, at least, receiving a preamble that includes two or more training sequences and deriving initial channel estimates in the frequency domain with the received preamble and a stored preamble. Chuang fails to correct for these deficiencies.

Kadous shows a system for estimating channels in a communication system using least squares estimation techniques. (Abstract). Kadous' receiver receives a signal and converts it from the time to frequency domain. (Fig. 1; col. 4, line 52-col. 5, line 2). The frequency-domain signal is input to a phase corrector and a channel estimator. (Fig. 1; col. 5, lines 2-9). Kadous' channel estimator includes a buffer, which receives a training sequence from the frequency-domain signal and stores the training sequence. (Fig. 2; col. 5, lines 14-17). A least squares

estimator performs division on the signal to determine a least squares channel estimate. (Col. 5, lines 16-19). A coefficient interpolator and channel estimator then determines final channel estimates for each channel by multiplying the least squares estimator's estimate by each channel's corresponding interpolation coefficient. (Col. 5, lines 25-28). Kadous' channel estimator passes this final estimate to a channel corrector, which in turn passes the corrected signal to a demodulator. (Fig. 1; col. 5, lines 5-9).

Kadous fails to teach or suggest receiving a preamble that includes two or more training sequences. The Examiner relies on the training sequences [A,B] and [C,D], which are transmitted respectively from antennas Tx1 and Tx2, as meeting this limitation. However, [A,B] is a matrix representation of the training sequence transmitted from *one* particular antenna, Tx1. Similarly, [C,D] is a matrix representation of the training sequence transmitted from another particular antenna, Tx2. (Col. 5, lines 39-49). Kadous does not show a single preamble that contains two or more training sequences – rather, Kadous shows multiple training sequences, each corresponding uniquely to a single and distinct antenna. Applicants respectfully assert that claim 1 is allowable over Kadous for at least these reasons.

Further, Kadous fails to teach or suggest deriving initial channel estimates in the frequency domain with the received preamble and a stored preamble. Kadous does not perform channel estimation by comparing received and stored preambles. Rather, in Kadous' system "[c]hannel estimation is performed by determining and then utilizing a least square (LS) estimate and an interpolation coefficient for each antenna transmitting to the receiver." (Abstract). As discussed above Kadous' least squares estimator determines a least squares channel estimate for each received signal, and the channel estimator obtains its final channel estimates by multiplying each channel's interpolation coefficient by the this least squares estimator estimate. (Col. 5, lines 17-28). Applicants respectfully assert that claim 1 is allowable over Kadous for at least these additional reasons.

Chuang, which shows a method of channel estimation based on iterative forward- and backward-processing, fails to correct for the deficiencies seen in Kadous. Applicants respectfully assert that the Examiner concedes as much, in that he relies on Chuang only as

showing the limitation of updating the channel estimate using the demodulated and decoded data symbols. Therefore, Applicants respectfully assert that claim 1 is allowable over the combination of Kadous and Chuang.

Claims 2-3, 5-24, and 97-98 depend from claim 1, and are allowable for at least the reasons given above with respect to claim 1.

Claim 2 is separately allowable for at least the following additional reasons. Claim 2 recites updating the channel estimate by performing operations on the demodulated and decoded data symbols, the operations excluding multiplication operations. The Examiner addresses this claim by stating that "the limitation has been disclosed in claim 1 (See claim 1, Chuang et al. fig 1A, receiver 140)." Applicants respectfully point out that there is nothing in Chuang that suggests specifically excluding multiplication operations from the operations used to demodulate and decode data symbols, and the Examiner has not pointed to one. Kadous does not cure this deficiency. Applicants respectfully assert that claim 2 is allowable for at least these additional reasons.

Claims 97 and 98 are also separately allowable for at least the following additional reasons. Claims 97 and 98 recite that the method is performed in a system complaint with IEEE 802.11a and IEEE 802.16a, respectfully. The Examiner acknowledges that Kadous fails to teach or suggest these limitations, but states that "the OFDM channel estimation of Kadous is inherent to be compliant to IEEE 802.11, 802.16a." Applicants respectfully submit that this is both incorrect and inappropriate as a basis for rejection. An OFDM system is not compliant with the various IEEE wireless standards simply by being an OFDM system. Indeed, if this were the case, there would be no need for IEEE standards to exist at all. Additionally, the fact that a certain result *may* occur is legally insufficient to establish inherency. Rather, to establish inherency the extrinsic evidence must show that the result or characteristic is necessarily present and would be so recognized by persons of ordinary skill. *See, e.g., In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999). The Examiner has made no such showing. Applicants respectfully assert that claims 97-98 are separately allowable for at least these additional reasons.

b. Claim 25 and its dependent claims

Claim 25 is directed to a communication device including a receiver, a Fourier transform module that performs a Fourier transform of two or more training sequences received in a preamble in a frequency domain, and a channel estimator that derives initial channel estimates in the frequency domain using the received preamble and a stored preamble. The communication devices further includes a decoder to demodulate and decode received data symbols and an update module that updates the channel estimate using the demodulated and decoded data symbols.

Applicants respectfully submit that claim 25 is allowable for at least the reasons given above with respect to claim 1.

Claims 26-27, 29-48, and 99-100 depend from claim 25, and are allowable for at least the reasons given above with respect to claim 25.

Claim 26 is also separately allowable for at least the additional reasons given above with respect to claim 2.

Claims 99 and 100 are also separately allowable for at least the additional reasons given above with respect to claims 97 and 98.

c. Claim 49 and its dependent claims

Claim 49 is directed to a communication device including means for receiving preambles and data symbols, means for performing a Fourier transform of two or more training sequences received in a preamble, and means for deriving initial channel estimates in the frequency domain using the received preamble and a stored preamble. The communication device further includes means for demodulating and decoding received data symbols and means for updating the channel estimate using the demodulated and decoded data symbols.

Applicants respectfully submit that claim 49 is allowable for at least the reasons given above with respect to claim 1.

Claims 50-51, 53-72, and 101-102 depend from claim 49, and are allowable for at least the reasons given above with respect to claim 49.

Claim 50 is also separately allowable for at least the additional reasons given above with respect to claim 2.

Claims 101 and 102 are also separately allowable for at least the additional reasons given above with respect to claims 97 and 98.

d. Claim 73 and its dependent claims

Claim 73 is directed to a computer program product that causes data processing apparatus to perform the steps of performing a Fourier transform of two or more training sequences received in a preamble across a channel, deriving initial channel estimates in the frequency domain with the received preamble and a stored preamble, demodulating and decoding the data symbols received across the channel, and updating the channel estimate using the demodulated and decoded data symbols.

Applicants respectfully submit that claim 73 is allowable for at least the reasons given above with respect to claim 1.

Claims 74-75, 77-96, and 103-104 depend from claim 73, and are allowable for at least the reasons given above with respect to claim 73.

Claim 74 is also separately allowable for at least the additional reasons given above with respect to claim 2.

Claims 103 and 104 are also separately allowable for at least the additional reasons given above with respect to claims 97 and 98.

No fees are believed to be due at this time. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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